

UNCLASSIFIED

AD NUMBER	
AD015010	
CLASSIFICATION CHANGES	
TO:	unclassified
FROM:	confidential
LIMITATION CHANGES	
TO:	Approved for public release; distribution is unlimited.
FROM:	Distribution authorized to U.S. Gov't. agencies and their contractors; Administrative/Operational Use; NOV 1952. Other requests shall be referred to Naval Weapons Lab., Dahlgren, VA.
AUTHORITY	
30 Nov 1964, DoDD 5200.10; USNSWC ltr, 6 Jan 1976	

THIS PAGE IS UNCLASSIFIED

CONFIDENTIAL

AD No. 15010  
ASTIA FILE COPY

U S NAVAL PROVING GROUND  
DAHLGREN, VIRGINIA

REPORT NO. 1048

RESEARCH AND DEVELOPMENT TESTS IN REPORT OF  
BOMB FUZING SYSTEMS

32nd Partial Report

ROCKET LAUNCHER TESTS OF  
ELECTRIC BOMB FUZE EX-200 MOD 3

FINAL Report

Task  
Assignment MPG-Re2b-20-1-52

Copy No. 6

Classification CONFIDENTIAL  
SECURITY INFORMATION

## Rocket Launcher Tests of Electric Bomb Fuze EX-200 Mod 3

PART ASYNOPSIS

1. The preceding phase of the test program on the EX-200 Mod 3 electric bomb fuze being developed by the Daystrom Electric Corp. produced the following results:

a. A satisfactory method of firing 250 lb. low drag bombs from the Naval Proving Ground's 500 ft. launcher.

b. The extended foil type of condenser functioned satisfactorily when subjected to cross-axial shocks but both types shorted out from shocks in an axial direction.

c. Two prearmed fuzes in 250 lb. G.P. bombs functioned satisfactorily on 1" STS plate fired at 900 ft./sec. with jiggle switches stiff enough to resist launcher vibrations.

d. Three EX-200 Mod 3 mock up fuzes (having timing circuits designed to arm the fuze between the end of the launcher and the target) tested for sensitivity in 250 lb. low drag bombs failed to fire upon impact with 1/4" STS plate target.

2. This test was conducted to:

a. Test fuzes with redesigned components intended to correct previous failures plus further development toward completion of fuze design.

b. Determine the impact sensitivity of the fuze with 35G trigger switches.

c. Determine the functional ability of the EX-200 Mod 3 fuze to arm and fire after heavy plate impact.

3. It is concluded that:

a. The mock up EX-200 Mod 3 bomb fuze containing a 35G trigger switch (as indicated by the limited number of rounds fired during this test) is sufficiently sensitive to function on 1/16" to 1/8" mild steel targets at a striking velocity of 900 ft./sec.

## Rocket Launcher Tests of Electric Bomb Fuze EX-200 Mod 3

b. The previous problem of consistent Condenser-Resistance-Condenser circuit failure during heavy impact tests has been corrected.

c. Faulty pyrotechnic actuators caused five arming failures during the heavy impact test.

d. Fuze functioning failure occurred on 1 out of 14 rounds as a result of having the S3 switch held down by extraneous material introduced during target penetration. Bomb Yaw at the time of impact would increase the exposure of the S3 switch to target debris.

4. It is recommended that:

a. The S3 switch be changed so that it can not cause sterilization of the fuze during impact and before the later stages of arming in the event that it is held down by material picked up during target penetration.

## Rocket Launcher Tests of Electric Bomb Fuze EX-200 Mod 3

TABLE OF CONTENTS

	<u>Page</u>
SYNOPSIS . . . . .	1
TABLE OF CONTENTS. . . . .	3
AUTHORITY. . . . .	4
REFERENCES . . . . .	4
BACKGROUND . . . . .	4
OBJECT OF TEST . . . . .	5
PERIOD OF TEST . . . . .	5
REPRESENTATIVES PRESENT. . . . .	5
DESCRIPTION OF ITEM UNDER TEST . . . . .	5
DESCRIPTION OF TEST EQUIPMENT. . . . .	6
PROCEDURE. . . . .	7
RESULTS OF TEST. . . . .	8
CONCLUSIONS. . . . .	9
RECOMMENDATIONS. . . . .	10
APPENDIX A - SENSITIVITY AND HEAVY IMPACT RESULTS . . . . .	TABLES I-II (Incl)
APPENDIX B - IMPACT RECORDS. . . . .	1-12 (Incl)
APPENDIX C - NPG PHOTOGRAPHS . . . . .	FIGURES 1-7 (Incl)
APPENDIX D - DISTRIBUTION. . . . .	1-2 (Incl)

## Rocket Launcher Tests of Electric Bomb Fuze EX-200 Mod 3

PART BINTRODUCTION

## 1. AUTHORITY:

This test was conducted in accordance with references (a), (b), (c), and (d) as authorized by reference (a) under Task Assignment NPG-Re2b-20-1-52.

## 2. REFERENCES:

- a. NOL conf ltr NP/NOL/X1-1(1258) WA:NCB:gbh Ser 01811 of 9 Oct 1951
- b. NOL Work Request WA-3 of 3 Dec 1951
- c. NOL Work Request WA-4 of 3 Dec 1951
- d. NOL Work Request WA-24 of 18 Mar 1952
- e. NPG Report No. 892 of 17 Dec 1951

## 3. BACKGROUND:

The preceding phase of the test program on the EX-200 Mod 3 electric bomb fuze being developed by the Daystrom Electric Corp. produced the following results:

- a. A satisfactory method of firing 250 lb. low drag bombs from the Naval Proving Ground's 500 ft. launcher.
- b. The extended foil type of condenser functioned satisfactorily when subjected to cross-axial shocks but both types shorted out from shocks in an axial direction.
- c. Two prearmed fuzes in 250 lb. G.P. bombs functioned satisfactorily on 1" STS plate fired at 900 ft./sec. with jiggle switches stiff enough to resist launcher vibrations.
- d. Three EX-200 Mod 3 mock up fuzes (having timing circuits designed to arm the fuze between the end of the launcher and the target) tested for sensitivity in 250 lb. low drag bombs failed to fire upon impact with 1/4" STS plate target.

## Rocket Launcher Tests of Electric Bomb Fuze EX-200 Mod 3

## 4. OBJECT OF TEST:

a. This test was conducted to:

(1) Test fuzes with redesigned components intended to correct previous failures plus further development toward completion of fuze design.

(2) Determine the impact sensitivity of the fuze with 35G trigger switches.

(3) Determine the functional ability of the EX-200 Mod 3 fuze to arm and fire after heavy plate impact.

## 5. PERIOD OF TEST:

a. Date Project Letter	9 October 1951
b. Dates Necessary Material Received	3 December 1951 26 May 1952
c. Date Commenced Test	4 December 1951
d. Date Test Completed	11 June 1952

## 6. REPRESENTATIVES PRESENT:

Mr. N. C. Butler	Naval Ordnance Laboratory
Mr. D. K. Tower	Daystrom Electric Corp.

PART CDETAILS OF TEST

## 7. DESCRIPTION OF ITEM UNDER TEST:

a. Photographs of the assembled EX-200 Mod 3 fuze and its components are shown as Figures 1, 2, and 3. Figure 4 is a schematic, electrical wiring diagram. The fuze has three electrical initiated pyro-delays which can be selected in accordance with the target.

## Rocket Launcher Tests of Electric Bomb Fuze EX-200 Mod 3

b. Component modifications and improvements incorporated in the fuze since date of tests reported in reference (e):

- (1) Improved high shock condensers.
- (2) Improved 2 sec. and 4-1/2 sec. pyrotechnic actuators.
- (3) Slight design changes in the top end of the fuze with particular regard to the rod which operates S3 switch to make it less susceptible to water entry and subsequent freezing.
- (4) Improvements in manufacturing processes on various fuze components without radical design changes.
- (5) Steel reinforcement sleeve 1/16" thick placed around the electrical component block to prevent distortion of the block by the heavy top end of the fuze during target impact.
- (6) Booster size reduced and booster cover crimped on instead of threaded on.
- (7) Fuze hermetically sealed between the fuze housing and bulkhead and between the housing and top end by the Metal-Matic process.

c. The mock up fuzes fired for target impact sensitivity consisted primarily of Condenser-Resistance-Condenser timing circuits, Victoreen Diode tubes and firing condensers, and primers connected to jiggle switches.

## 8. DESCRIPTION OF TEST EQUIPMENT:

## Test Vehicles:

250 lb. G.P. Bomb AN-M57A1 Vermiculite-Cement loaded with cross-axial fuze liner midway.

250 lb. Low Drag Bomb EX-2, Vermiculite-Cement loaded. Figure 5

## Rocket Launcher Tests of Electric Bomb Fuze EX-200 Mod 3

Propelling Force for  
Test Vehicles:

250 lb. G.P. Bomb-Three 5"0 rocket  
motors Mk 2 Mod 3 mounted in special  
carriage.

250 lb. Low Drag Bomb-Three 5"0  
rocket motors Mk 2 Mod 3 mounted in  
special carriage with 3"25 motor  
Mk 7 in tail of bomb. The 3"25  
motor was used primarily to separate  
the bomb from the carriage.

## Launcher:

NPG 500 ft.

## Fuze Charging Equipment:

Daystrom Electric Corp.

## Targets:

1/32", 1/16", 1/8", 1/4" mild steel,  
1/2", 3/4", 1" STS (homogenous armor  
plate).

7032, 1/16", and 1/8" 24ST aluminum  
alloy, 1/4", 1/2", 3/4" plywood.

## Velocity Measurements:

Counter chronograph and oscillograph.

## Cameras:

35mm Mitchell and Bowen Acceleration.

## 9. PROCEDURE:

a. Rounds 1 through 21, fired for impact sensitivity, were charged at the muzzle of the launcher; charging voltage was 270 volts D.C. The 3"25 separation motors on rounds 1 through 12 were ignited 55 ft. before the end of the launcher.

b. On rounds 22 through 26 the separation motor was ignited at the muzzle of the launcher.

c. On rounds 22 through 26 the fuze charging screens were increased in length from 30" to 50", thus increasing the charging time.

d. The 17 rounds fired for heavy plate impact had their condensers charged before firing with 200-210 volts D.C. Before each round was fired the fuzes and charging gear were electrically tested.

## Rocket Launcher Tests of Electric Bomb Fuse NX-200 Mod 3

e. The first five rounds fired for heavy plate impact were 250 lb. Low Drag Bombs, partially cement loaded. The fuzes contained all components except the tetryl lead-ins and live boosters. They were not hermetically sealed and had threaded booster covers.

f. The last 12 rounds fired for heavy plate impact were hermetically sealed and had crimped booster covers.

## 10. RESULTS OF TEST:

a. Tabulated test results are found in Tables I and II. Detailed impact records are found in Appendix (B).

b. Results of the sensitivity test were rather inconclusive due to the small number of rounds fired. However, using a 35G switch, a 1/16" or 1/8" mild steel target was sufficient to cause detonation of more than 50% of the fuzes fired at them, Figure 6.

c. During the sensitivity tests two fuzes with 35G switches detonated prematurely, approximately 25 ft. before the target. This may have been caused by excessive vibration in the bomb built up during its flight down the launcher or possibly as a result of an interruption in the burning of the 3725 separation motor in the tail of the bomb. Such interrupted burning might produce a deceleration in the round.

d. On many of the sensitivity tests two targets were used. A thin target was placed at 200 ft. from the launcher muzzle and a heavier one at 250 ft. was certain to provide sufficient deceleration to cause the fuze to function. Consequently, the number of rounds fired, as shown in the tables, do not correspond to the number of target results indicated.

e. Most of the dud rounds occurring on 1/16", 1/8" and 1/4" mild steel targets resulted during a period in which it is believed there may have been some fault in the fuze charging method. Several changes in the charging method (but not in the fuzes), prior to the last 5 rounds fired, resulted in successful functioning on targets which had previously produced duds.

f. Additional tests of target sensitivity will be conducted during the evaluation program.

## Rocket Launcher Tests of Electric Bomb Fuze EX-200 Mod 3

## g. Summary of Heavy Impact Test (in 250 lb. G.P. bombs)

<u>No. of Rounds</u>	<u>STS Target</u>	<u>Striking Velocity</u>	<u>Fuze Delay Arming</u>	<u>Fuze Functioning</u>	<u>Fuze Dud</u>
5	1"	Average 900 ft./sec.	Approx. 10 sec.	2	3
6	3/4"	Average 900 ft./sec.	Approx. 10 sec.	2	4

Note: One round fired against 1" STS was not recovered and is not listed in above results.

(1) A study of Table II (Heavy Plate Impact Test) shows that the charging procedure was not the cause of the seven duds. The defect in five appears to be a failure of the pyrotechnics to operate their respective switches. In one case the Condenser-Resistance-Condenser circuits may have failed. The last failure may have been caused by the discharging of part of the Condenser-Resistance-Condenser circuit energy through the S3 switch which was held down by wood from the target impact. The recovered fuzes have been delivered to the Naval Ordnance Laboratory for further investigation. Figure 7 shows a typical round in flight during the heavy impact test.

PART DCONCLUSIONS

## 11. It is concluded that:

a. The mock up EX-200 Mod 3 bomb fuze containing a 35G trigger switch (as indicated by the limited number of rounds fired during this test) is sufficiently sensitive to function on 1/16" to 1/8" mild steel targets at a striking velocity of 900 ft./sec.

b. The previous problem of consistent Condenser-Resistance-Condenser circuit failure during heavy impact tests has been corrected.

## Rocket Launcher Tests of Electric Bomb Fuze EX-200 Mod 3

c. Faulty pyrotechnic actuators caused five arming failures during the heavy impact tests.

d. Fuze functioning failure occurred on 1 out of 14 rounds as a result of having the S3 switch held down by extraneous material introduced during target penetration. Bomb Yaw at the time of impact would increase the exposure of the S3 switch to target debris.

PART ERECOMMENDATIONS

12. It is recommended that:

a. The S3 switch be changed so that it can not cause sterilization of the fuze during impact and before the later stages of arming in the event that it is held down by material picked up during target penetration.

CONFIDENTIAL

NPG REPORT NO. 1048

Rocket Launcher Tests of Electric Front Fuz. EX-200 Mod 3

-----

The tests upon which this report is based were conducted by:

F. W. KASDORF, Rocket Battery Officer  
Rocket Battery  
Terminal Ballistics Department

This report was prepared by:

F. W. KASDORF, Rocket Battery Officer  
Rocket Battery  
Terminal Ballistics Department

This report was reviewed by:

R. H. LYDDANE, Director of Research  
Terminal Ballistics Department  
E. L. LEVSTIK, Lieutenant Commander, USNR  
Terminal Ballistics Batteries Officer  
Terminal Ballistics Department  
W. B. ROBERTSON, Lieutenant Commander, USN  
Terminal Ballistics Officer  
Terminal Ballistics Department  
C. C. BRAMBLE, Director of Research, Ordnance Group

APPROVED: J. F. BYRNE  
Captain, USN  
Commander, Naval Proving Ground

*E. A. Ruckner*

E. A. RUCKNER  
Captain, USN  
Ordnance Officer  
By direction

CONFIDENTIAL  
SECURITY INFORMATION

CONFIDENTIAL

REF ID: A6542

U. S. NAVAL PROVING GROUND  
DAHLGREN, VIRGINIA

Thirty-Second Partial Report

on

Research and Development Tests in Report of  
Bomb Fuzing Systems

First Partial Report

on

Rocket Launcher Tests of  
Electric Bomb Fuze EX-200 Mod 3

Project No.: NPG-Re2b-20-1-52  
Copy No.: 6  
No. of Pages: 11

Date: NOV 12 1952

CONFIDENTIAL  
SECURITY INFORMATION

lobas boll

POLYMER LETTERS

## APPENDIX A

POLYMER LETTERS

mag. 50902

11

STATE PLATE DEPT. 1937 (ANDREW MELLON REPORT)

CONFIDENTIAL

## IMPACT RECORD

U. S. NAVAL PROVING GROUND  
DAHLGREN, VIRGINIA

IMPACT NO. 39966

IMPACT DATE 2-26-52

NPG TEST NO. T-2219-1.8

OBJECT Impact test of electric bomb fuze in 250 lb. G. P.  
BombReference: NPG Vol. ~~1048~~ REPORT No. 1048

dated

Reference: ~~Spec ltr. NPG~~ NPG

dated

Task Assignment No. ~~1048~~

dated

## PLATE TARGET

Gage 0.75 Class STS  
Maker U. S. Steel  
No. 0157663 Group U-S26-832  
Dimensions 8 1/2" x 250"

OBLIQUITY 0°

PENETRATION Complete

Thickness at impact .75

No. of impact on plate 3

Dist. from nearest impact 4" "

Dist. from near edge 46" and 118"

Impact area 13" x 22"

Spall: Front 0 Back 0

Dish 3" Spur 7"

Cracks 0

Punching (thrown) (started)

Back Button (thrown) (started)

Bulge 0

Through opening 12" x 19"

## BOMB

## ROCKET

HEAD: Cal. Mark 57 Mod No. Wt. 250.0#  
Type G. P. Bomb  
Maker  
Lot No.  
Filler: Type Verm Wt. -  
Fuzes Ex-200 Mod 2 No 1925  
w/ primers and dets.  
Boosters 2  
Wt. of head (as fired) 250.0#MOTOR: Cal. 5" Mk. 2 Mod 3  
Motor temp. 90° ft. 80.90#COMPLETE ROUND: Mark Mod  
Wt. (as fired) 330.90#  
Wt. (burned) "

OTHER INFORMATION RMDA-110-MA-45

" " "  
" -087- "

LAUNCHER 500 ft. Launcher

## ROCKET PERFORMANCE

mean

Flight Velocity, f/s: Starting .911 Residual  
Fuze functioning  
Explosive action (High Order) (Low Order) (None)  
Distance of burst behind plate  
Condition of recovered round  
Head was in (EFFECTIVE) (REMOVED) condition.

REMARKS: 2 sec during actuator fire. 31 sec. 4 1/2 sec during actuator fire. 18 sec. 2 sec during actuator fire. 32 sec. did not clock. The prime time 3 ms. in. It was in the right position.

Photo No. \_\_\_\_\_

Signed *F. W. Kastor* *RTC*

R. T. CROWELL, 1h

Ord. Eng.

CONFIDENTIAL

SECURITY INFORMATION

CONFIDENTIAL

## IMPACT RECORD

U. S. NAVAL PROVING GROUND  
DAHLGREN, VIRGINIA

IMPACT NO. 39967

IMPACT DATE 5-27-52

NPG TEST NO. T-2219-1.8

OBJECT Impact test of electric bomb fuze in 250 lb. G.P. Bomb

Reference: NPG N.W. 1st. Report No. 1048

dated

Reference: ENQWAD ltr. NADL/X1-1/1258 SA:RCS

dated 11/11/51 of 9 Oct 1951

Task Assignment No. NPG-1-1-1

dated 4 Aug 1951

## PLATE TARGET

Gage 0.75 Class STS  
Maker U. S. Steel  
No. 0157663 Group U-S26-832  
Dimensions 83-1/2" x 250"

OBLIQUITY 0°

PENETRATION Complete  
Thickness at Impact .75  
No. of impact on plate 4  
Dist. from nearest impact 42"  
Dist. from near edge T48" and L160"  
Impact area 18" x 48"  
Spall: Front 0 Back 0  
Dish 4" Spur 3"  
Cracks 0  
Punching (thrown) (started)  
Back Button (thrown) (started)  
Bulge 0  
Through opening 17" x 47"

## BOMB

HEAD: Cal. 5" Mark M57 Mod 2  
Type G. P. Bomb No. 250.0#  
Maker  
Lot No.  
Filler: Type Verm. Wt.  
Fuzes Ex-200 Mod 3 No. 176 w/ primers and dets.  
Boosters 2  
Wt. of head (as fired) 250.0#MOTOR: Cal. 5" Mk. 2 Mod 3  
Motor temp. 90° Wt. 80.25#COMPLETE ROUND: Mark 2  
Wt. (as fired) 330.85#  
Wt. (burned)OTHER INFORMATION RMDA-56-HA-45  
" -119- "  
" -1019- "  
LAUNCHER 500 ft. Launcher

## ROCKET PERFORMANCE

Flight Velocity f/s: Mean 927 Residual  
Fuze functioning (High Order) (Low Order) (None)  
Explosive action (High Order) (Low Order) (None)  
Distance of burst behind plate  
Condition of recovered round  
Head was in (EFFECTIVE) (INFFECTIVE) condition.REMARKS: Impact 1/4" into plate  
2 sec. actuator fired S, switch closed. 4 sec. actuator fired S, closed  
11 sec. power fired

Photo No.

Signed *F.W. Kaasdon for RTC*R. T. CROVELL, 1h  
Ord. Engr.

CONFIDENTIAL

## IMPACT RECORD

CONFIDENTIAL

U. S. NAVAL PROVING GROUND IMPACT NO. 39968  
DAHLGREN, VIRGINIA

IMPACT DATE 5-27-52

NPG TEST NO.T-2210-1.8

OBJECT Impact test of electric bomb fuze in 250 lb. G.P. Bomb

Reference: NPG NDL Rep. Report No. 1248 dated  
 Reference: ENORD ltr. NDL/X1-1(1258) dated 21 Oct 1951  
 Task Assignment No. NPG-Fe2b-20-1-52 dated 4 Aug 1951

## PLATE TARGET

Gage 0.75 Class STS  
 Maker U. S. Steel  
 No. 0138073 Group U-S26-822  
 Dimensions 90" x 250"

OBLIQUITY 0°

PENETRATION Complete

Thickness at Impact .75

No. of impact on plate 3

Dist. from nearest impact 49"

Dist. from near edges 46" and 138"

Impact area 16" x 22"

Spall: Front 0 Back 0

Dish 3" Spur 13"

Cracks 0

Punching (thrown) (started)

Back Button (thrown) (missed)

Bulge 0

Through opening 15" x 21"

## ROCKET

BOMB HEAD: Cal. 5" Type G.P. Bomb  
 Mark M57 Mod No. Wt. 250.0#

Maker

Lot No.

Filler: Type Verne, Wt.

Fuzes Ex-200 Mod 3 No. 124  
w/primers and dets.Boosters 2  
Wt. of head (as fired) 250.0#

MOTOR: Cal. 5" Mk. 2 Mod 3  
 Motor temp. 90° Wt. 78.60#

COMPLETE ROUND: Mark Mod  
 Wt. (as fired) 328.60#  
 Wt. (burned)

OTHER INFORMATION RMDA-1020-HA-45  
 " = 957- "  
 " = 991- "

LAUNCHER 500 ft. Launcher

## ROCKET PERFORMANCE

Flight Velocity, f/s: Mean 944 Residual  
 Fuze functioning

Explosive action (High Order) (Low Order) (None)

Distance of burst behind plate

Condition of recovered round INTACT

Booster Head was in (EFFECTIVE) (INFFECTIVE) condition.

REMARKS: (Handwritten notes: "After impact, the fuze functioned but did not detonate. Fuze head exploded with intact booster remaining intact. No external burnishing."

Photo No. \_\_\_\_\_

Signed F.W. Kassor for RTC

R. T. CROWELL, 1h  
Ord. Eng.

CONFIDENTIAL

SECURITY INFORMATION

## IMPACT RECORD

CONFIDENTIAL

U. S. NAVAL PROVING GROUND  
DAHLGREN, VIRGINIA

IMPACT NO. 39969

IMPACT DATE 5-27-52

NPG TEST NO. T-2219-1.8

OBJECT Impact test of electric bomb fuze in 250 lb. G.P. Bomb

Reference: NPG ~~1883~~ Report 1078  
Reference: ~~Ex-200~~ ltr. AF/NOL/XI-1 (1258) WKA:FCB  
Task Assignment No. NPG-Ref-2b-1-1-52dated  
dated 5 Oct 1951  
dated 4 Aug 1951

## PLATE TARGET

Gage 1"0 Class STS  
Maker Lukens  
No. #50 Group L-30  
Dimensions 96" x 348"

OBLIQUITY 0°

PENETRATION Complete  
Thickness at impact 1"0  
No. of impact on plate 3  
Dist. from nearest impact 0  
Dist. from near edges T49 and R57"  
Impact area 17" x 23"  
Spall: Front 0 Back 0  
Dish 4" Spur 1"  
Cracks 0  
Punching (thrown) (started)  
Back Button (thrown) (started)  
Bulge 0  
Through opening 16-1/4" x 22-1/4"

## ROCKET

## BOMB

HEAD: Cal. 5" Mod 2 Type G. P. Bomb  
Mark M52 Mod No. Wt. 250.0#  
Maker  
Lot No.  
Filler: Type Ver. Wt.  
Fuzes Ex-200 Mod 3 42, 226  
w/ primers and dets.  
Boosters 2  
Wt. of head (as fired) 250.0#MOTOR: Cal. 5" Mk. 2 Mod 3  
Motor temp. 90° Wt. 80.75#COMPLETE ROUND: Mark Mod  
Wt. (as fired) 330.75#  
Wt. (burned) "OTHER INFORMATION RD-1025-45  
" -1025- "  
" - " "

LAUNCHER 500 ft. Launcher

## ROCKET PERFORMANCE

Flight Velocity, f/s: Mean 940 Residual  
Fuze functioning ~~none~~  
Explosive action (High Order) (Low Order) (None)  
Distance of burst behind plate  
Condition of recovered round ~~none~~  
The round was in (EFFECTIVE) (INOPERATIVE) condition.REMARKS: ~~none~~ ~~none~~  
Fuze arced

Photo No.

Signed

F. W. Kaedor, Jr. R. T. CROMELL, Jr.

Ord. Eng.

CONFIDENTIAL

SECURITY INFORMATION

CONFIDENTIAL

## IMPACT RECORD

U. S. NAVAL PROVING GROUND IMPACT NO. 39972  
 DAHLGREN, VIRGINIA  
 IMPACT DATE 5-28-52  
 NPG TEST NO. T-2219-1.8

OBJECT Impact test of Ex-200 Electric Bomb Fuze in  
250# G. P. Bomb

Reference: NPG 1st 1/25/52 dated 10-7-52  
 Reference: Ex-200 1/25/52 dated 10-7-52  
 Task Assignment No. 10-26-2-1-2 dated 4-11-52

PLATE TARGET

Gage 1"0 Class STS  
 Maker Lukens  
 No. 50 Group L-30  
 Dimensions 96" x 348"

OBLIQUITY 0°

PENETRATION Complete  
 Thickness at Impact 1"0  
 No. of impact on plate 4  
 Dist. from nearest impact 42"  
 Dist. from near edges 42" and 1152"  
 Impact area 14" x 23"  
 Spall: Front 0 Back 0  
 Dish 3" Spur 5"  
 Cracks 0  
 Punching (thrown) (started)  
 Back Button (thrown) (started)  
 Bulge 0  
 Through opening 12" x 21"

BOMB

HEAD: Cal. Mark M57 Mod No. Type G.P. Bomb  
 Wt. 250.0#  
 Maker -  
 Lot No. -  
 Filler: Type Ver. Wt.  
 Fuze Ex-200 Mod 3 #1078, with  
primers and detonators  
 Boosters 2  
 Wt. of head (as fired) 250.0#

MOTOR: Cal. 5 Mk. 2 Mod 3  
 Motor temp. 95° Wt. 80.65#

COMPLETE ROUND: Mark Mod  
 Wt. (as fired) 330.65#  
 Wt. (burned) -

OTHER INFORMATION RMDA-619-HA-45  
" -56-H-45  
" -100- "

LAUNCHER 500 ft. Rocket Launcher

## ROCKET PERFORMANCE

Flight Velocity, f/s: Starting Mean 957 Residual -  
 Fuze functioning 1/2 1/2 1/2  
 Explosive action (High Order) (Low Order) (None)  
 Distance of burst behind plate -  
 Condition of recovered round F intact  
 Head was in (EFFECTIVE) (INACTIVE) condition.

REMARKS: 11 sec. primer fired into booster. Fuzes armed.

Photo No. -

Signed R. T. CROWELL, Th  
Ord. Eng.

## IMPACT RECORD

CONFIDENTIAL

U. S. NAVAL PROVING GROUND  
DAHLGREN, VIRGINIA

IMPACT NO. 39973

IMPACT DATE 5-28-52

NPG TEST NO. T-2219-1.8

OBJECT Impact test of Ex-200 Electric Bomb Fuze in  
250# G.P. BombReference: NPG ~~Report~~ No. 1048

dated

Reference: ~~Exord Xtr. N.Y./RUL/AL-1(1258) 24: NPG~~

dated 24 Oct 1951 or 7 Oct 1951

Task Assignment No. NPG-3020-20-1-52

dated 4 Aug 1951

## PLATE TARGET

Gage 1"0 Class STS  
 Maker Lukens  
 No. 50 Group L-30  
 Dimensions 96" x 348"

OBLIQUITY 0°

PENETRATION Complete

Thickness at Impact 1"0

No. of impact on plate 5

Dist. from nearest impact 35"

Dist. from near edges 18" and 115"

Impact area 18" x 39"

Spall: Front 0 Back 0

Dish 5" Spur 34"

Cracks 0

Punching (thrown) (started)

Back Button (thrown) (started)

Bulge 0

Through opening 16" x 36"

## BOMB

HEAD: Cal. 5" Mark M57 Mod 3 Type G.P. Bomb  
 Maker - Wt. 250.0#  
 Lot No. -  
 Filler: Type Ver. Wt.  
 Fuze Ex-200 Mod 3 #1073 with  
 primers & dets  
 Boosters 2  
 Wt. of head (as fired) 250.0#

MOTOR: Cal. 5" Mk. 2 Mod 3  
 Motor temp. 95° Wt. 80.10#

COMPLETE ROUND: Mark 3 Mod  
 Wt. (as fired) 330.10#  
 Wt. (burned) "

## OTHER INFORMATION RMDA-957-HA-45

" -100-H-15

" " "

LAUNCHER 500 ft. Rocket Launcher

## ROCKET PERFORMANCE

Flight Velocity, f/s: Mean 939 Residual  
 Fuze functioning  
 Explosive action (High Order) (Low Order) (None)  
 Distance of burst behind plate  
 Condition of recovered round ~~42 not recovered~~  
 Head was in (EFFECTIVE) (INEFFECTIVE) condition.

REMARKS: Gauge not required.

Photo No. \_\_\_\_\_

Signed \_\_\_\_\_

*R. T. Crowell*  
 R. T. CROWELL, 1h  
 Ord. Eng.

CONFIDENTIAL  
SECURITY INFORMATION



CONFIDENTIAL

## IMPACT RECORD

U. S. NAVAL PROVING GROUND  
DAHLGREN, VIRGINIAIMPACT NO. 40000IMPACT DATE 6-9-52

NPG TEST NO.T-2219-1,8

OBJECT Impact Test of EX-200 Electric Bomb Fuze in 250#  
J.P. Bomb vs 170 Plate.Reference: NPG 1st. Report No. 1048  
Reference: NAOLtr. NE/NAOL/Y1-1(1258) A.N.C.B.  
Task Assignment No NPG Re2b-20-1-52

dated

dated Serial of 9 Oct 1951dated 4 Aug 1951PLATE TARGETGage 170 Class SIS  
Maker Carn.  
No. 043796 Group   
Dimensions 8'9" x 10'4" x 1"OBLIQUITY 0°PENETRATION CompleteThickness at impact 170No. of impact on plate 2Dist. from nearest impact 0Dist. from near edge .51" and .76"Impact area 12" x 21"Spall: Front 0 Back 0Dish 2" Spur 2"Cracks 0

Punching (thrown) (started)

Back Button (thrown) (started)

Bulge 0Through opening 11" x 20-1/2"ROCKETHEAD: Cal. 5" Type G.P. Bomb  
Mark ANL57 Mod A1 No. Wt. 252.00#  
Maker   
Lot No.   
Filler: Type Var. Wt.   
Fuzes EX-200 Mod. 3 No 1208  
"Primer, Det. & Arming SquibsBoosters 2Wt. of head (as fired) 252.00#MOTOR: Cal. 5" Mk. 2 Mod 3  
Motor temp. 120° Wt. 79.95#COMPLETE ROUND: Mark  Mod   
Wt. (as fired) 331.95#  
Wt. (burned) OTHER INFORMATION ALN:RMDA-22-HA-45  
" -880-HA-45  
" -1240-HA-45LAUNCHER 1050' Rocket Launcher  
(500')ROCKET PERFORMANCEFlight Mean Velocity, f/s: Starting 948 Residual   
Fuze functioning   
Explosive action (High Order) (Low Order) (None)   
Distance of burst behind plate   
Condition of recovered round Intact  
Bomb shell was in (EFFECTIVE) (EFFECTIVE) condition.REMARKS: 2 sec. after fire 5, switch closed, 4th sec. after switch did not fire. 5, switch open 11sec. primer fired 3nd sec. did not armPhoto No. Signed F.W. KasdorfF.W. Kasdorf  
ORN. ENG.

## IMPACT RECORD

CONFIDENTIAL

U. S. NAVAL PROVING GROUND  
DAHLGREN, VIRGINIA

IMPACT NO. 40005

IMPACT DATE 6-10-52

NPG TEST NO. T-2219-1.8

OBJECT Impact test of Ex-200 Electric Bomb Fuze in  
250# G. P. Bomb

Reference: NPG Nal ltr. Report No. 1048

dated

Reference: Board ltr.

dated

Task Assignment No.

dated

XXXXX NF/NOL/YI-1(1258) & A: NCH  
PLATE TARGET 20-20-1-52Ser 01811 of 9 Oct 1/51  
ROCKET 951Gage 1"0 Class STS  
Maker CARNEGIE  
No. 043796 Group  
Dimensions 105" x 220"HEAD: Cal. Type G. P. Bomb  
Mark ANM57 Mod A-1 No. Wt. 250.00#OBLIQUITY 0°  
PENETRATION Complete  
Thickness at impact 1"0  
No. of impact on plate  
Dist. from nearest impact 44"  
Dist. from near edge 34" and 1100  
Impact area 32" x 12"  
Spall: Front - Back -  
Dish 3-1/2" Spur -  
Cracks -  
Punching (thrown) (started)  
Back Button (thrown) (started)  
Bulge -  
Through opening 31" x 11-1/2"Maker  
Lot No.  
Filler: Type Verm Wt.  
Fuzes Ex-200 Mod 3 with primers  
Dets and armine squids No 1053  
Boosters 2  
Wt. of head (as fired) 250.00#MOTOR: Cal. 5" Mk. 2 Mod 3  
Motor temp. 120° Wt. 79.10#COMPLETE ROUND: Mark Mod  
Wt. (as fired) 320.10#  
Wt. (burned)OTHER INFORMATION RHDA-695-HA-45  
" " = 169-HA-45  
" " = 833-HA-45

LAUNCHER 500 ft. Launcher

## ROCKET PERFORMANCE

Flight Velocity, f/s: Striking 753 Residual  
Fuze functioning  
Explosive action (High Order) (Low Order) (None)  
Distance of burst behind plate  
Condition of recovered round INACT Side of bomb flattened  
Head was in (EFFECTIVE) (INEFFECTIVE) condition:REMARKS: 2 sec. actuator fired. 5, switch open, 4/5 sec actuator did  
not fire. So switch would have primed but did not fire.  
It is possible that the pyrotechnics had only a full charge

Photo No.

Signed F. W. Kaedor for RTC

R. T. CROWELL, Jr.

Ord. Eng.

CONFIDENTIAL  
SECURITY INFORMATION

CONFIDENTIAL

## IMPACT RECORD

U. S. NAVAL PROVING GROUND IMPACT NO. 40006  
DAHLGREN, VIRGINIAIMPACT DATE 6-10-52NPG TEST NO. T-2219-1.8OBJECT Impact test of Ex-200 Electric Bomb Fuze in  
250# G. P. BombReference: NPG NOL ltr. Report No. 1048 dated 10 Jun 51Reference: Board ltr. 10 Jun 51 dated 10 Jun 51Task Assignment No. NPAG/11-1(125c) NARROW dated 10 Jun 51PLATE TARGET 10 Jun 51 BOMB 10 Jun 51 ROCKET 10 Jun 51Gage 0.78 Class STSMaker LukensNo. 41 Group L 21Dimensions 96" x 348"OBLIQUITY 30°PENETRATION CompleteThickness at impact 0.78No. of impact on plate 3Dist. from nearest impact -Dist. from near edge 35" and 106"Impact area 40" x 20-1/2"Spall: Front - Back -Dish 4 Spur -Cracks -

Punching (thrown) (started)

Back Button (thrown) (started)

Bulge ---Through opening 21" x 35"HEAD: Cal. 5" Type G.P. BombMark ANM57 Mod A-1 No. Wt. 250.00#Maker Lot No. Filler: Type Verm. Wt.Fuzes Ex-200 Mod 3 with primers  
dets., and arming squids N91026Boosters 2Wt. of head (as fired) 250.00#MOTOR: Cal. 5" Mk. 2 Mod 3Motor temp. 120° Wt. 79.50#COMPLETE ROUND: Mark  Mod Wt. (as fired) 329.50#Wt. (burned) OTHER INFORMATION RLDA-400-NcA-45" -426-HA-45" -833-HA-45LAUNCHER 500 ft. Launcher

## ROCKET PERFORMANCE

Flight Mean Velocity, f/s: 954 Residual Fuze functioning 

Explosive action (High Order) (Low Order) (None)

Distance of burst behind plate Condition of recovered round INTACT

Head was in (EFFECTIVE) (INEFFECTIVE) condition.

REMARKS: 2 sec. actuator fired. S. switch open, 4 1/2 sec. actuator  
did not fire. S. switch open. If open primer did not fire  
It is possible that the pyrotechnic lacked a fall chargePhoto No.  Signed F. W. Koenig for RTCR. T. CROWELL, JR.  
ORD. ENG.CONFIDENTIAL  
SECURITY INFORMATION

## IMPACT RECORD

CONFIDENTIAL

U. S. NAVAL PROVING GROUND  
DAHLGREN, VIRGINIA

IMPACT NO. 40007

IMPACT DATE 6-11-52

NPG TEST NO.T-2219-1.2

OBJECT Impact test of Ex-200 Electric Bomb Fuze in  
250# G. P. Bomb

Reference: NPG Nolter. Report No. 1248

Reference: BuOrd ltr.

Task Assignment No.

Ref. Orl 1 of 9 Oct 1951

AP/PA/AT-1(1253) 1951

PLATE TARGET

ROCKET

Gage 0.78 Class STS  
Maker Lukens  
No. 41 Group L21  
Dimensions 96" x 348"

OBLIQUITY 45°

PENETRATION Complete  
Thickness at Impact 0.78  
No. of impact on plate 4  
Dist. from nearest impact 115"  
Dist. from near edges T58 and R45"  
Impact area 16" x 45"  
Spall: Front 0 Back 0  
Dish 5" Spur 17"  
Cracks 0  
Punching (thrown) (started)  
Back Button (thrown) (started)  
Bulge 0  
Through opening 15" x 43"HEAD: Cal. Mark ANW57A Mod No. Type G.P. Bomb  
Maker No. 250.00#  
Lot No.Filler: Type Verm. Wt.  
Fuze Ex-200 Mod 3 No. 1172  
(explosive unknown)Boosters 2  
Wt. of head (as fired) 250.00#MOTOR: Cal. 5" Mk. 2 Mod 3  
Motor temp. 120° Wt. 82.30#COMPLETE ROUND: Mark Mod  
Wt. (as fired) 332.30#  
Wt. (burned)OTHER INFORMATION RMDA-1240-HA-45  
" -400-LCA-45  
" -991-HA-45

LAUNCHER 500 ft. Launcher

## ROCKET PERFORMANCE

Flight Velocity, f/s: Mean 946 Residual  
Fuze functioning  
Explosive action (High Order) (Low Order) (None)  
Distance of burst behind plate  
Condition of recovered round (INTACT)  
Head was in (EFFECTIVE) (condition)REMARKS: 2 sec actuator fired. S. switch partially closed. 4½ sec  
actuator did not fire. So open 11 sec pyro. Did not fire  
It is possible that the pyrotechnic helped a full charge

Photo No.

Signed F. W. Kassner for RTC  
R. T. CROWELL, Th  
Ord. Eng.CONFIDENTIAL  
SECURITY INFORMATION

CONFIDENTIAL

## IMPACT RECORD

U. S. NAVAL PROVING GROUND  
DAHLGREN, VIRGINIA

IMPACT NO. 40008

IMPACT DATE 6-11-52

NPG TEST NO. T-2219-1.8

OBJECT Impact test of Ex-200 Electric Bomb Fuze in 250#  
G. P. Bomb

Reference: NPG ltr. Report No. 1045

dated

Reference: DAQDR ltr. NPA/DA/1(1258)44-NCR

dated

Task Assignment No. NEC-5e2b-20-1-52

dated 26 Dec 1951

dated 6 Aug 1951

## PLATE TARGET

Gage 0.78 Class STS  
Maker Lukens  
No. 41 Group L21  
Dimensions 96" x 34.8"

OBLIQUITY 45°

PENETRATION Complete  
Thickness at impact 0.78  
No. of impact on plate 5  
Dist. from nearest impact 63"  
Dist. from near edge 11" and 14.2"  
Impact area 17" x 34"  
Spall: Front 0 Back 0  
Dish 4" Spur 13"  
Cracks 0  
Punching (thrown) (started)  
Back Button (thrown) (started)  
Bulge 0  
Through opening 16" x 29"

## Bomb

## ROCKET

HEAD: Cal. Mark ANM57A1 Mod No. G. P. Bomb  
Type Wt. 250.00#  
Maker  
Lot No.  
Filler: Type Verm. Wt.  
Fuzes Ex-200 Mod 3 141224  
(explosive unknown)Boosters 2  
Wt. of head (as fired) 250.00#MOTOR: Cal. 5" Mk. 2 Mod 3  
Motor temp. 120° Wt. 80.85#COMPLETE ROUND: Mark Mod  
Wt. (as fired) 330.85#  
Wt. (burned) "OTHER INFORMATION RMDA-957-HA-45  
" 1020-HA-45  
" " "

LAUNCHER 500 ft. Launcher

## ROCKET PERFORMANCE

Flight Velocity, f/s: Starting 952 Residual  
Fuze functioning (yes)  
Explosive action (High Order) (Low Order) (None)  
Distance of burst behind plate  
Condition of recovered round intact  
Head was in (EFFECTIVE) (INEFFECTIVE) condition.REMARKS: A switch functioned but did not cause the switch  
to open. Primer did not fire. It is possible that the pyrotechnic  
locked a full charge.

Photo No.

Signed

F. T. Kasdorf for RTC  
R. T. CROWELL, LTP  
ORD. ENG.CONFIDENTIAL  
SECURITY INFORMATION

NP9-50746

Electric Bomb Fuze

Ex-200

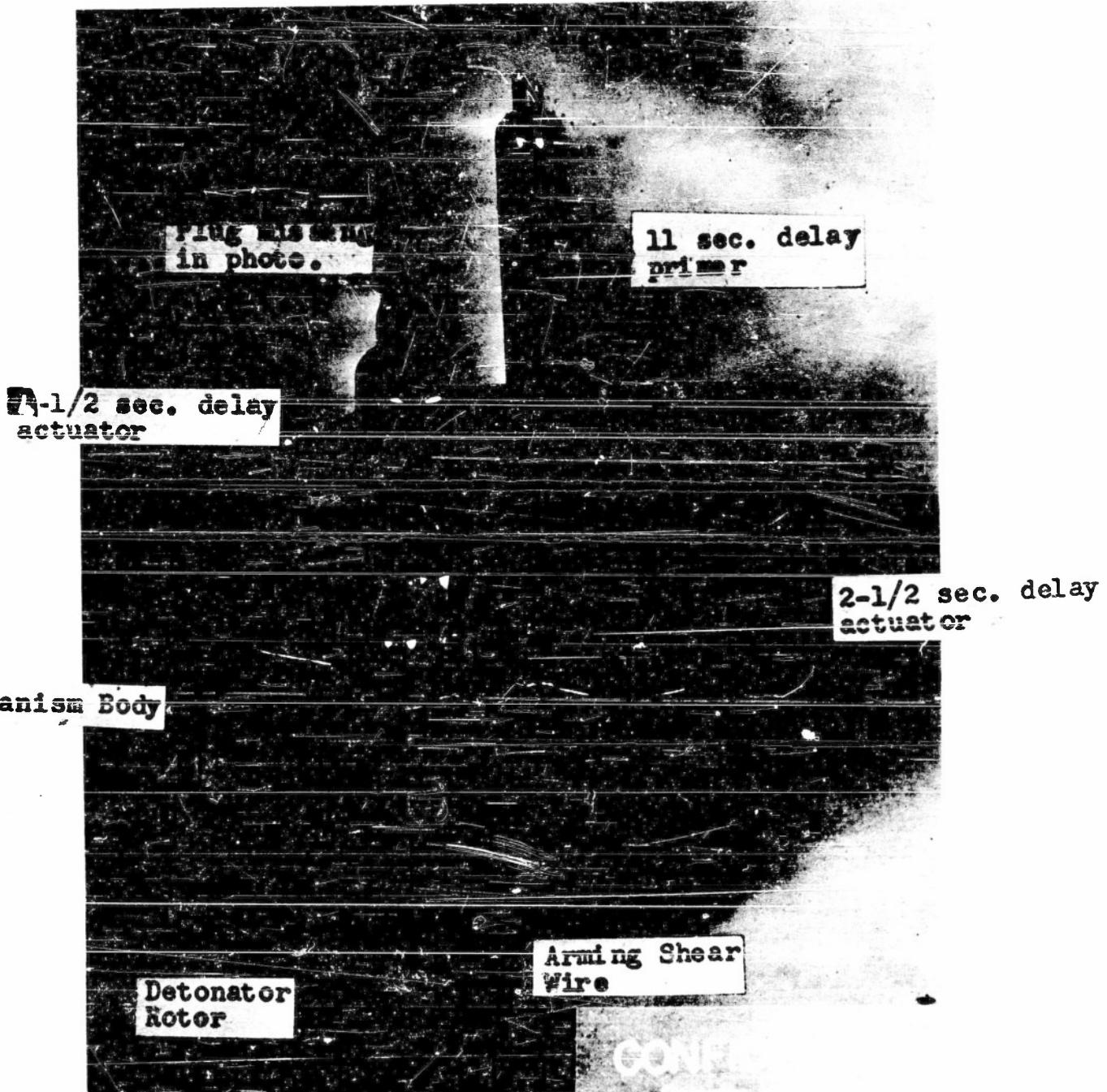
Mod 3

View:

Assembled fuze and its components.

CONFIDENTIAL  
SECURITY INFORMATION





NP9-50742

Electric Bomb Fuze Ex-200 Mod 3. View: Mechanical Component Block.

Figure 2

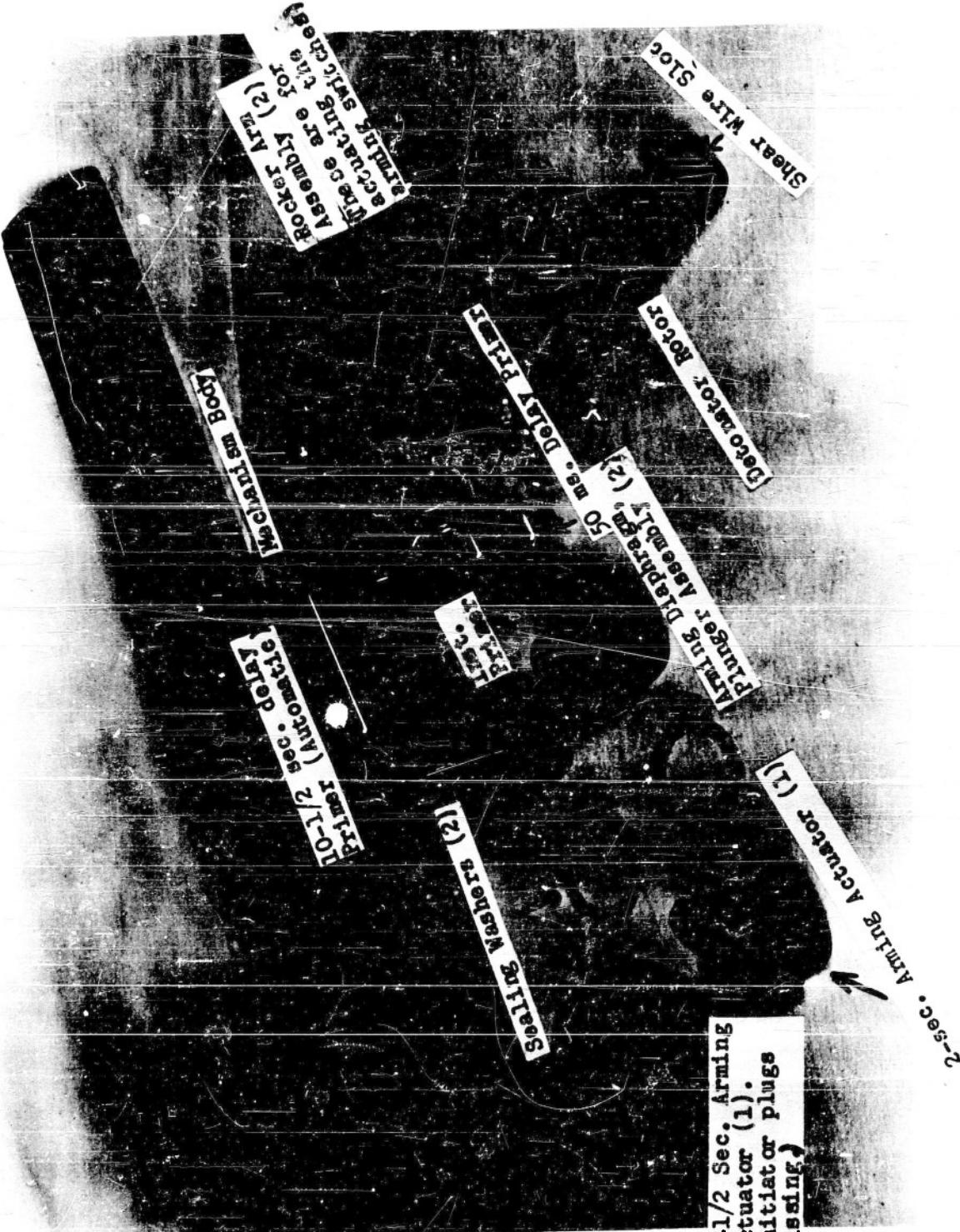
CONFIDENTIAL

SECURITY INFORMATION

Electric Month Futures - 200  
Commodity Stock.

View: 3

CONFIDENTIAL  
SECURITY INFORMATION  
Mechanical

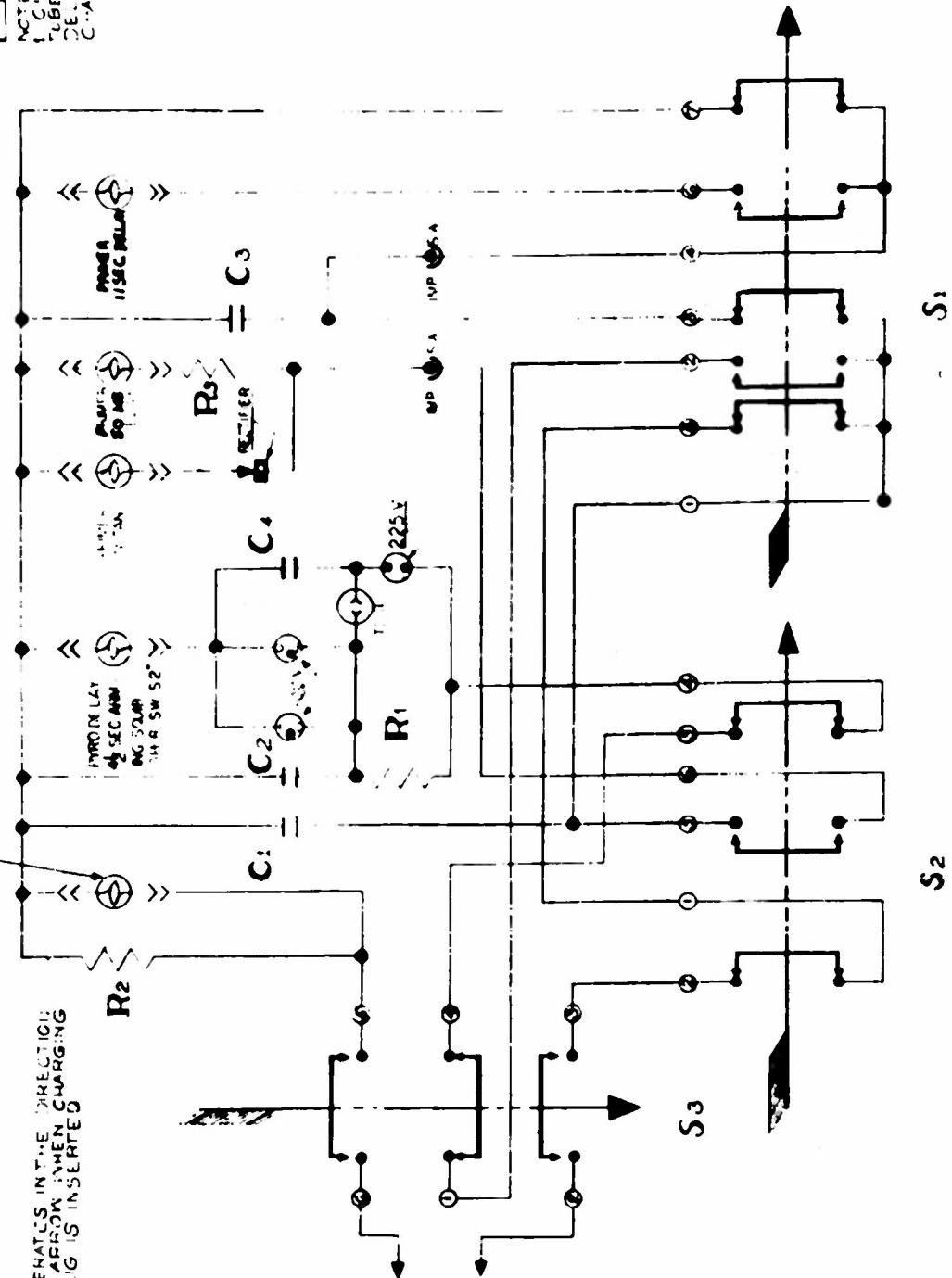


mp. 47295

BY ALEXANDER 2 SEC. SCUTUS

OPERATES IN THE DIRECTION OF A FLOW WHEN CHARGING, AND IS INSERTED

NOTES: P1 C2 AND P1 C2  
12BF TO 65 SEC  
DEA AND C111  
C-MARGE TO 95 VC

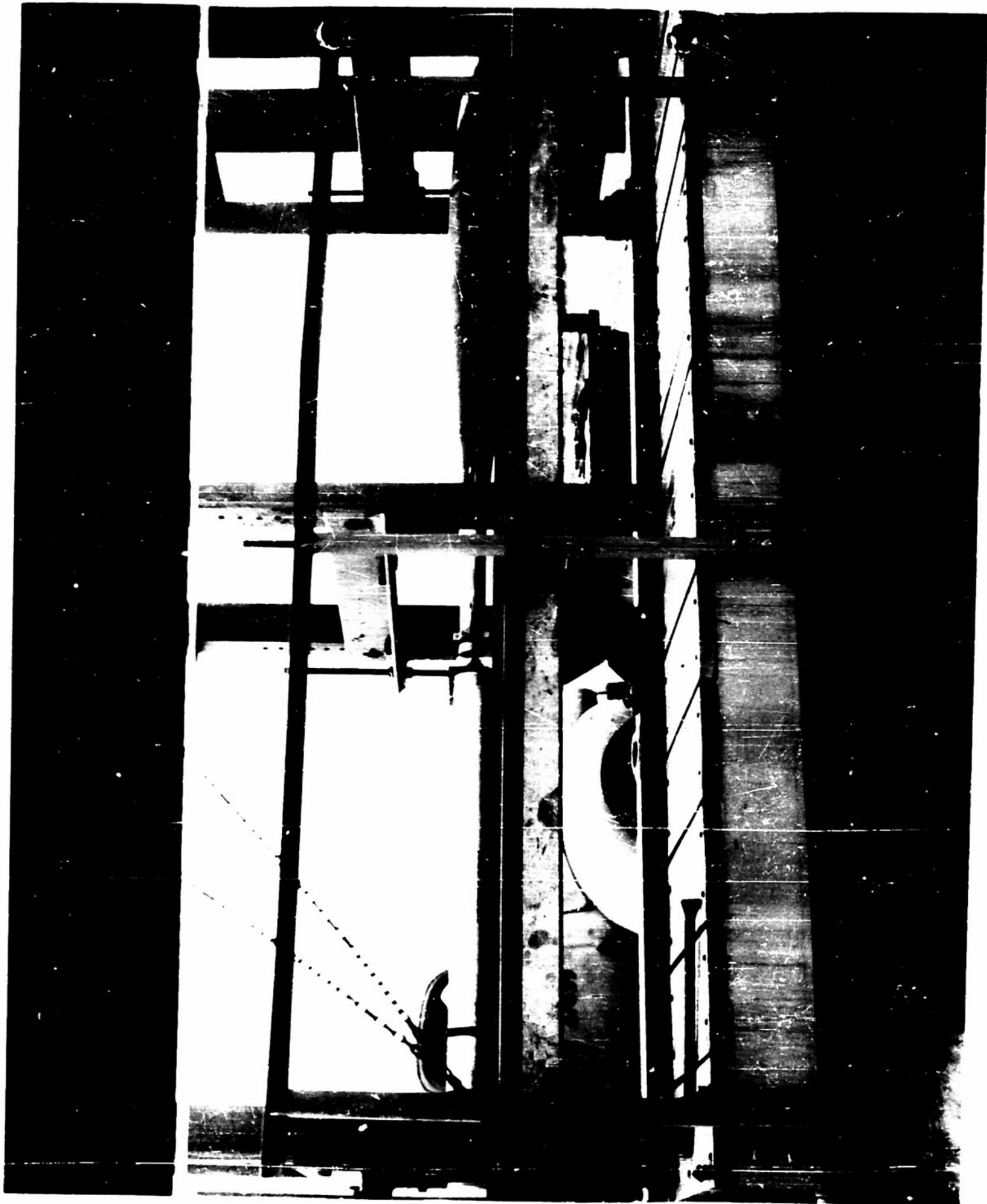


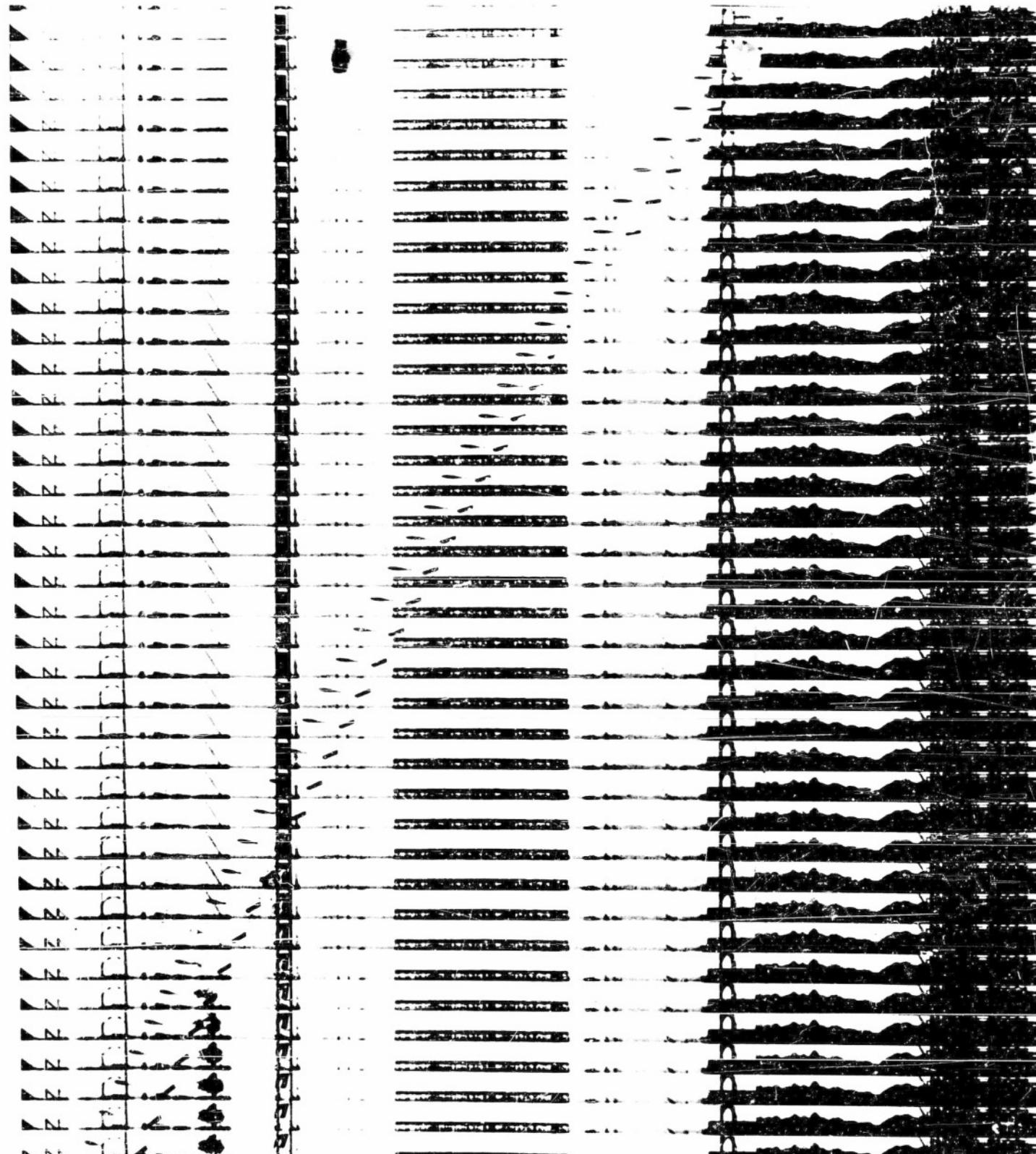
५

52

169-8059-459

## ELECTRICAL SCHEMATIC DIAGRAM





CONFIDENTIAL

SECURITY INFORMATION

P9-47032  
Electric Bomb Fuze Ex-200 Mod-3. View: Typical Sensitivity Test.  
Shot with fuze N 250 lb. Low Drag Bomb Ex-2 fired from NPG 500 ft.  
launcher. Bomb propelled by three 5"0 HVAR motors in special  
carriage. Separation obtained by use of 3"25 motor in tail of  
bomb. Note separation of bomb and carriage and fuze action  
appr ximately 20 ft. beyond target.

NRG-50752  
Electric Bomb Fuze EX 200 Mod 3  
250 lb. G.P. bomb fired from M10  
500 ft. launcher with three 500 lb. moors.

CONFIDENTIAL  
SECURITY INFORMATION  
View: Typical heavy impact test shot with fuze in  
(Figure 7)



CONFIDENTIAL

NPG REPORT NO. 1048

Rocket Launcher Tests of Electric Bomb Fuze EX-200 Mod 3

-----

DISTRIBUTION

Bureau of Ordnance:

Ad3	1
Re2	1
Re2b	2
Chief of Ordnance Department of the Army Attn: ORDTX-AR	2
Commanding General Aberdeen Proving Ground Aberdeen, Maryland Attn: Technical Information Section Development and Proof Services	1
Commander Operational Development Force U. S. Atlantic Fleet, U. S. Naval Base Norfolk 11, Virginia	1
Navy Research Section Library of Congress Washington 25, D. C. (Via BUORD, Re2)	2
Naval Gun Factory Attn: Aircraft Armament Section	1
Bureau of Aeronautics Attn: Armament Section	2
NATC, Patuxent River, Maryland	3
NAOTS, Chincoteague, Virginia	1
Air Material Command Liaison Officer Wing 3 Headquarters, Aberdeen Proving Ground Aberdeen, Maryland	2
Naval Liaison Officer USAFFPGC, Eglin Field, Florida	1

CONFIDENTIAL  
SECURITY INFORMATION

CONFIDENTIAL

NPG REPORT NO. 1048

Rocket Launcher Tests of Electric Bomb Fuze EX-200 Mod 3

-----

DISTRIBUTION (Continued)

Naval Air Development Center Johnsville, Pa.	1
U. S. Air Force, AMC Engineering Field Office Room 1833, Main Navy Building Navy Department, Washington, D. C.	2
Commander (DF) Naval Ordnance Laboratory	3
Commanding Officer, Picatinny Arsenal Dover, New Jersey Attn: Technical Division	1
Commanding General Air Material Armament Test Center Eglin Air Force Base, Florida	1
NOTS, Inyokern, China Lake, California	1
NOTS, Inyokern, China Lake, California Attn: Explosives Department Aviation Ordnance and Test Department	1
Daystrom Electric Corp., Poughkeepsie, N. Y. Attn: Mr. T. C. Smith, Chief Engineer (Via BUORD, Section Re2b)	1
Commanding Officer Picatinny Arsenal Dover, New Jersey Attn: Technical Division-Bomb Unit	1
Local:	
OT	1
OV	1
File	1